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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/003,386	10/30/2001	Mun-Mo Jeong	9898-188	5352

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EXAMINER

GEBREMARIAM, SAMUEL A

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 03/27/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/003,386

Applicant(s)

JEONG, MUN-MO

Examiner

Samuel A Gebremariam

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 November 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-13 and 21-25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-13 and 21-25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other:

DETAILED ACTION

According to rule 1.126 claims 14-18 have been renumbered as claims 21-25 respectively.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-13, are rejected under 35 U.S.C. 103(a) as being unpatentable over Bost et al., US patent No. 5,231,053 in view of admitted prior art.

Regarding claim 1, Bost teaches (figs. 2-7) a method for manufacturing a semiconductor device comprising: forming interconnection layer (22), including a capping layer (30) the capping layer defining a contact resistance, and an etching stopper (32) on a semiconductor substrate (26); forming an interlayer insulating layer (34) overlying the interconnection layer (22); forming a first contact hole (hole formed within layer 34) exposing a surface of the etching stopper (32); removing portion of the etching stopper exposed by the first contact hole, thereby forming second contact hole (hole formed within layer 32) to leave the capping layer of the interconnection layer at substantially the same thickness such that the contact resistance of the interconnection layer are substantially uniform; and forming a conductive layer (38) within the second hole.

Bost does not explicitly teach forming a plural interconnection layers and the formation first and second contact holes.

It is conventional and also taught by admitted prior art (fig. 1) to form plural interconnection layer (14) and contact holes (20a, 20b and 20c, page 1, line 23-29).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form more than one interconnection layers and contact holes taught by admitted prior art in the process of Bost in order to form a functional device. The modified process would result in an interconnection layers at substantially the same thickness such that the contact resistances of the plural interconnection layers are substantially uniform.

Regarding claim 2, Bost teaches (figs. 2-7) substantially the entire claimed process of claim 1 above including the method of claim 1 further comprising forming third contact holes (hole formed in layer 30) by slightly etching a portion of the capping layer (30) exposed by the second contact holes before forming the conductive layer, and wherein the conductive layer is formed within the second contact holes and the third contact holes.

Regarding claim 3, Bost teaches substantially the entire claimed method of claim 1 above including the conductive layer is formed only in the second and third contact holes.

Regarding claim 4, Bost teaches substantially the entire claimed method of claim 1 above including the conductive layer is an upper interconnection layer filling the

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second and third contact holes and covering the top surface of the interlayer-insulating layer (fig. 6, col. 4, lines 44-57).

Regarding claim 6, Bost teaches substantially the entire claimed method of claim 1 above including the etching stopper is formed of an inorganic anti-reflecting layer (32) (ARL) that is titanium nitride.

Regarding claim 7, Bost teaches substantially the entire claimed method of claim 1 above including the interconnection layer is a metal layer containing aluminum (col. 2, line 61-65).

Regarding claim 8, Bost teaches substantially the entire claimed method of claim 1 above including the capping layer (30) is formed of TiN (col. 3, line 6-25).

Regarding claim 9, Bost teaches substantially the entire claimed method of claim 1 above including the interlayer-insulating layer (34) is formed of silicon oxide layer (col. 3, line 52-61).

Regarding claim 10, Bost teaches (figs. 2-7) substantially the entire claimed method of claim 1 above including the interconnection layer, the capping layer, and the etching stopper are formed by sequentially depositing material layers for forming the interconnection layer, the capping layer, and the etching stopper, and patterning the material layers by the same etching process.

Regarding claim 11, Bost teaches substantially the entire claimed method of claim 1 above including the conductive layer is formed only in the second contact hole (fig. 6).

Regarding claim 12, Bost teaches substantially the entire claimed method of claim 1 above including the conductive layer is an upper interconnection layer filling the second contact hole and covering the top surface of the interlayer insulating layer (fig. 6, col. 4, lines 44-57).

Regarding claim 13, Bost teaches substantially the entire claimed method of claim 1 above including the first contact hole is formed by using a dry etching method (col. 4, line 1-8).

Regarding claim 21, Bost teaches substantially the entire claimed method of claim 1 above including the capping layers are etched to form uniform thickness among the second contact holes.

Regarding claim 22, Bost teaches substantially the entire claimed method of claim 1 above including the second contact holes expose a top surface of the capping layers.

Regarding claim 23, Bost teaches (fig. 5) substantially the entire claimed process of claim 1 above including selectively removing the material layer (30) in such a manner that the capping layers (30) within the contact holes are of uniform thickness.

Regarding claim 24, Bost teaches (fig. 5) substantially the entire claimed process of claim 1 above including the capping layers are etched to form a uniform thickness in the contact holes.

Regarding claim 25, Bost teaches (fig. 5) substantially the entire claimed process of claim 1 above including the contact holes expose a top surface of the capping layers.

Claim 5, is rejected under 35 U.S.C. 103(a) as being unpatentable over Bost and admitted prior art and in view of Maniar et al. US patent No. 5,702,981.

Regarding claim 5, Bost teaches substantially the entire claimed method of claim 1 above including the second and third contact holes are formed by performing a dry etching method (col. 4, lines 1-8)

Bost in view of admitted prior does not explicitly teach using an etchant having a low etching selectivity between the etching stopper and the capping layer.

The use etchant having low etching selectivity between etch stop and capping layer is conventional and Maniar also teaches (fig. 4, col. 6, lines 1-24) etching etch stop layer (40) and capping layer (38) using etchant that etches the capping layer slower than the etch stop layer.

It would have been obvious to one of ordinary skill in the art at the time the invention was method to incorporate the process step taught by Maniar in the process of Bost in order to have better control on the etching process.

Response to Arguments

3. Applicant's arguments with respect to claims 1-13 and 21-25 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

4. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within

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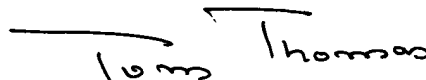
TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Samuel Admassu Gebremariam whose telephone number is 703 305 1913. The examiner can normally be reached on 8:00am-4: 30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (703) 305-7646. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Samuel Admassu Gebremariam
March 19, 2003


TOM THOMAS
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800